(12) UK Patent Application (19) GB (11) 2 160 456 A

(43) Application published 24 Dec 1985

(21) Application No 8432826

(22) Date of filing 31 Dec 1984

(30) Priority data

(31) 533625 (32) 22 Jun 1984 (33) ES

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(51) INT CL^4
B22D 27/04

(52) Domestic classification
B3F GK

(56) Documents cited
GB 1303030 GB 0578123
GB 1138404 GB 0362333
"Principles of Metal Casting", Heine and Rosenthal, McGraw-Hill 1955, pages 45 to 46 and 226 to 227

(58) Field of search
B3F

(54) Casting method

(57) Electrodes (1) or coils supply heat such that as the molten metal cools and solidifes to form cast body 4), the resulting contraction in volume is filled by excess metal from the critical zones (2). The heating is applied to the zone at which the excess metal enters the mould containing the cast body (4), so as to overcome problems associated with cooling. Also, the entire cast body (4) is heated to reduce the cooling rate and thereby permit the excess metal to take up the space in the mould resulting from the volumetric contraction that occurs upon solidification.

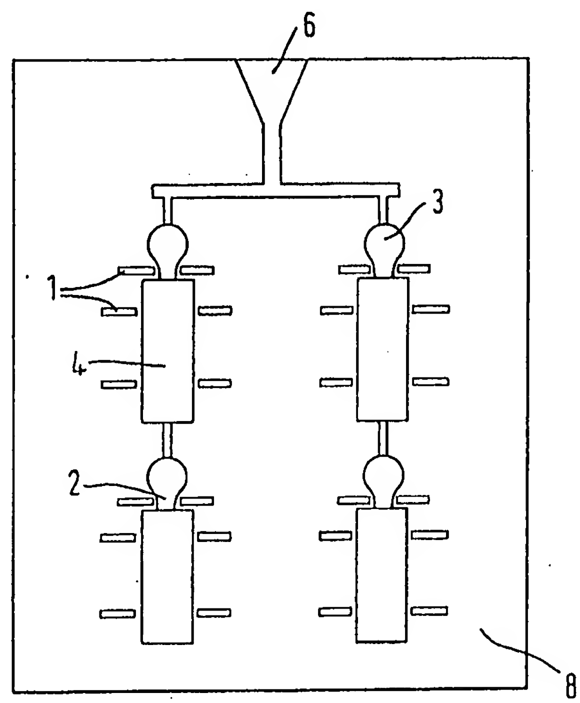

FIG. 1

The drawing(s) originally filed was (were) informal and the print here reproduced is taken from a later filed formal copy.

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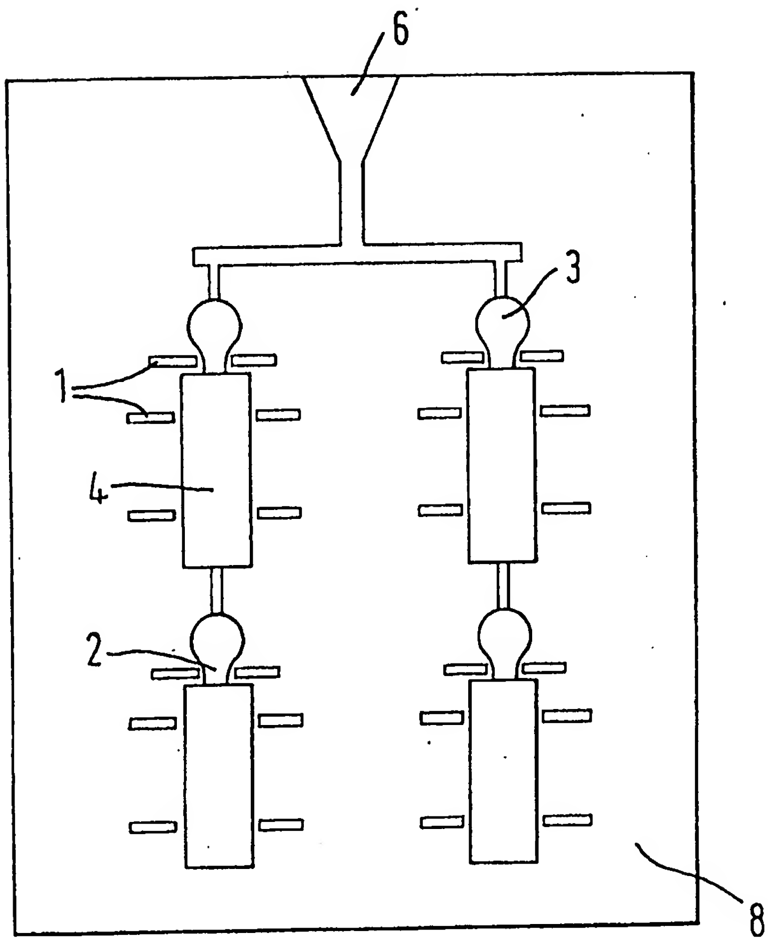
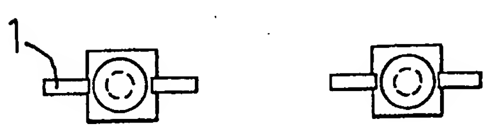


FIG. 1



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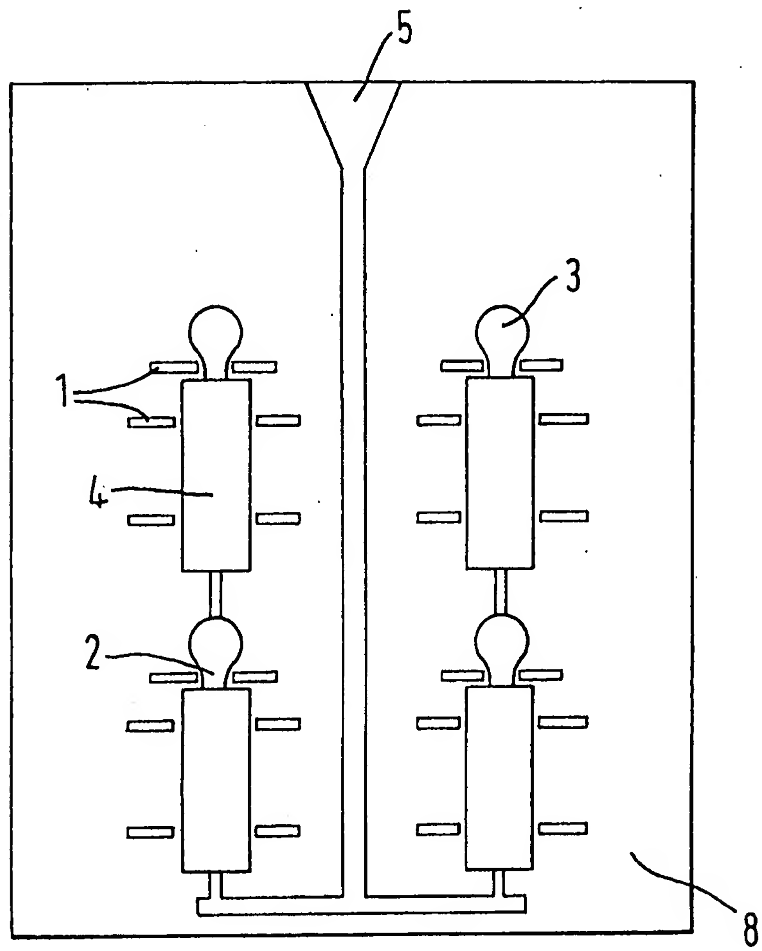
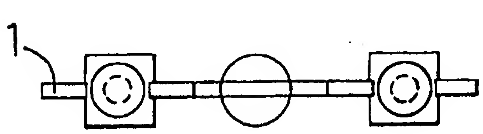


FIG. 2



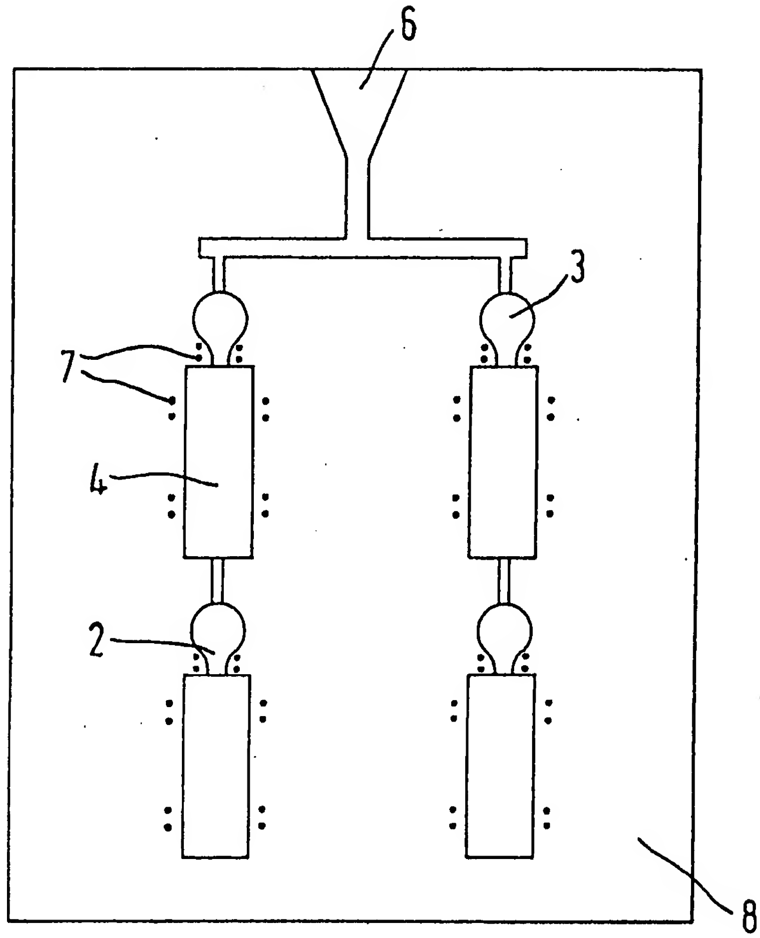


FIG. 3

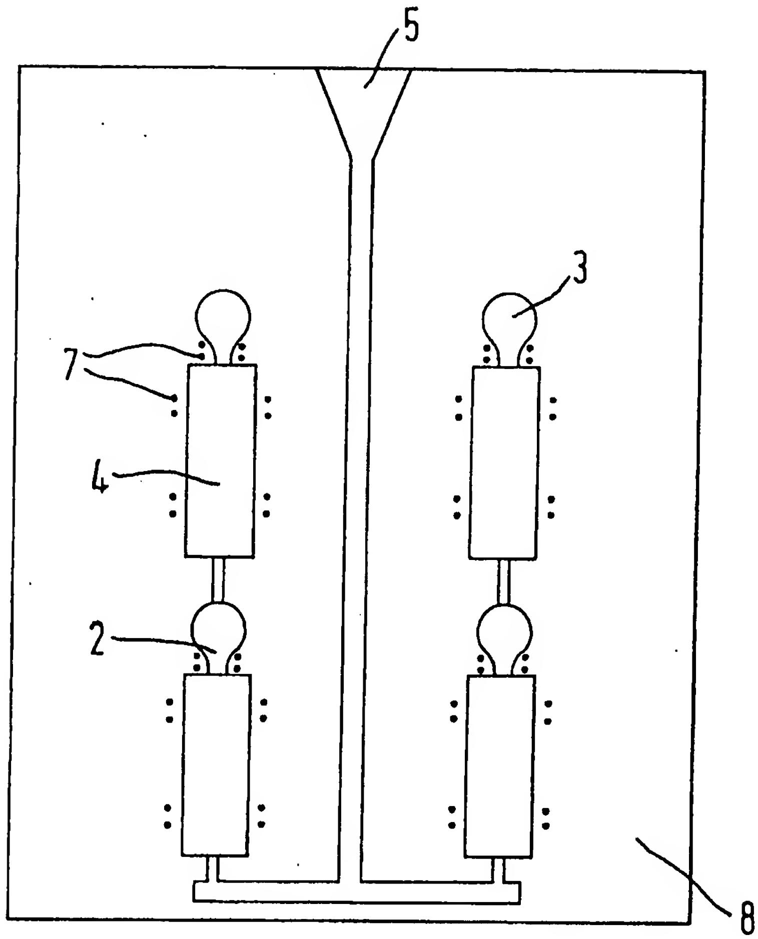
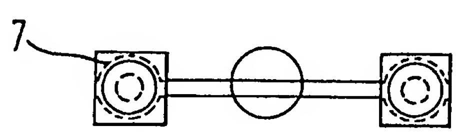


FIG. 4



SPECIFICATION

Moulding method for cast alloys

This invention relates to a moulding method using a metal mould wherein one or a plurality of zones of the mould are kept hot for example for casting alloys of grey iron, alloyed iron, nodular iron, steel or non-ferrous alloys.

For a number of years it has been attempted to cast various types of non-ferrous alloys in metal moulds, with the aim of eliminating the numerous problems which occur during moulding with sand agglomerates using various methods.

Whilst there have been considerable advances in the field of metals and alloys having a low melting point, considerably less has been achieved with respect to ferrous components, such as grey and alloyed iron, nodular iron and in particular steel. The main difficulties are due to the numerous problems which occur in carrying out solidification of a compound having a high melting point poured into a casting mould. In particular a substantial volumectric contraction occurs as the molten metal solidifies from the liquid state. The contraction can be offset by feeding a supply of metal into the mould as the contraction occurs, but the metal feed needs to be dissolved in records, which is difficult because it comes into contact with a mould which may have a thermal diffusivity greater than sand and in some cases increased by additional cooling.

This arises particularly in the case of alloyed iron, and especially in the case of steel, there is a decrease in volume. In order to offset this decrease in volume, it is necessary to supply the additional metal flux precisely at the point at which the final solidification takes place. This is the aim of the additional masses of flux, which are known as excess metal components in moulding processes.

Further difficulties arise when casting in metal moulds since the thermal diffusivity of the mould is considerably greater than that of the sand and the contraction of the component takes place very rapidly, and is in some cases acelerated by the forced cooling of the mould with air or water.

In conventional moulding processes use is made of insulating and exothermic caps designed to keep the metal contained in the excess metal components liquid for as long as possible. The use of these caps in the case of fusion in a metal mould raises serious drawbacks in particular in the case of mass production, since these components must be disposed in suitable housing, fastened in some way which is not always readily possible and in particular the residues must be removed before the next casing. In addition, the volume proportion of these excess metal components must be considerable in comparison with the size of the component, given the speed at which the metal of the mould itself cools.

In the case in which it is attempted to cast a number of components in different portions of the same mould, the above method cannot be used as the gases arising from the metal/casing reaction would cause major problems.

In contrast, the present invention enables any additional element within the metal mould to be dispensed with, with the object of being able to supply the required amount of flux to achieve a complete compaction of the cast component, starting from the minimum possible volume of excess metal.

In accordance with the invention, no deleterious combustion or chemical reactions need take place, no harmful gases need be occluded in the cast component, thereby also reducing the risk of environmental pollution.

The invention also enables the casting of several components in the same mould, these components being supplied one after the other, since at the time of solidification, each component has an independent cooling means.

The present invention also permits a reduction of the junction section between the component and the excess metal, which enables savings in materials and a considerable reduction in work with respect to the separation of the excess metal and the componet and the subsequent finishing of the cast component.

Broadly stated the invention provides a moulding method wherein metallic material to be cast is fed into a metal mould, and excess metal is fed to the mould to take up the mould space vacated as a result of volumetric contraction of the material upon solidification, including selectively heating the material in such a manner as to slow the cooling rate from that which would otherwise occur.

The following is a description of examples of the method in which use is made of a metal mould or shell with the number of ducts considered suitable to obtain one or more components from each casting.

Reference will be made hereinafter to the accompanying drawings wherein Figures 1 to 4 comprise schematic views of different mould configuration/ or use in the exemplary methods.

The mould is formed by two symmetrical or asymmetrical portions with a corresponding system of distribution channels, inlets, outlets, ducts for the evacuation of gases and, in this case, the corresponding excess metal components.

Filling of the mould may take place using the method considered most suitable using gravity casting, i.e. cascade, pressure casting etc., and combining this method with the heating in the critical zones designated by the reference numeral 2. The heating may be carried out be heating electrodes 1 or by heating coils 7. Pressure gravity casting is shown in the drawings by 5, and when casting is carried out using the cascade method, this is shown in the drawings by 6. The excess metal components are designed by 3 and the cast component by 4. The reference 8 indicates a metal mould shown by way of non-limiting example.

In accordance with the method selected, the following elements are located in each portion of the mould:

In Figures 1 and 2 one or more electrodes 1 of graphite or other material, opposite their counterparts in the opposite mould portion and insulated

from the mould by a ceramic sheath so that they do not project. These electrodes are inserted via the rear portion of the mould 8 such that the external end may be connected to the energy source.

In Figures 3 and 4 one or more half coils 7 whose two ends project onto the surface of each mould half such that on connection of the two portions they may form loops. Ths coils may or may not come into direct contact with the flux. These half coils are also inserted via the rear portion of the mould portions and connected to an electric current source induced for high or normal frequency fields.

At the point of termination which depends on the material being cast, the type of component, the size of the excess metal component, the type of cooling used, the casting system etc., the corresponding device is connected and, in the minimum time required, supplies the power required to produce in each case the appropriate heating to delay solidification in the area designed to supply the flux to the cavity provided in the component before the latter passes completely into the solid state.

Stated differently, when the mould 8 is filled with molten metal e.g. grey iron, alloyed iron, steel or non-ferrous alloys, excess metal gathers in the critical zones 2. The electrical supply to the electrodes 1 or the coils 7 is switched on to heat the arrangement. The heating is performed in such a way that as the molten material cools and solidifies to form the cast body 4, the resulting contraction in volume is filled by excess metal from the critical zones 2. The heating is applied to the zone at which the excess metal enters the mould containing the body 4, so as to overcome the aforesaid problems associated with cooling. Also the entire body 4 is heated to reduce the cooling rate, thereby to permit the excess metal to suitably take up the space in the mould resulting from the volumetric contraction that occurs upon solidification.

CLAIMS

1. A moulding method wherein metallic material to be cast is fed into a metal mould, and excess metal is fed to the mould to take up the mould space vacated as a result of volumetric contraction of the material upon solidification, including selectively heating the material in such a manner as to slow the cooling rate from that which would otherwise occur.

2. A moulding method according to claim 1 including selectively electrically heating the supply of excess material in the region where it feeds into the mould.

3. A moulding method according to claim 1 or 2 wherein said heating is performed by electrodes contacting the material to be cast.

4. A moulding method according to claim 1, 2 or 3 wherein the heating is performed by electric induction heating.

5. A moulding method according to any preceding claim wherein the material to be cast comprises grey iron, alloyed iron, nodular iron, compacted graphite iron, or steel or non-ferrous alloys.

6. A moulding method using a metal mould wherein one or a plurality of zones of the mould are kept hot, and designed for cast alloys to be poured therein, eseentially characterised in that it comprises a method of regulation over time of the temperature of the metal cast in a mould so as to delay the solidification at certain zones by means of the supply of heat energy provided by electric current.

7. A moulding method according to claim 6 wherein the heating is performed by electrodes.

8. A moulding method according to claim 6 or 7 wherein the heating is performed by induced currents.

9. A moulding method using a metal mould wherein one or a plurality of zones of the mould are kept hot, and designed for cast alloys to be poured therein, essentially characterised in that it comprises a moulding and casting method for components cast in mould, these components being of grey iron, alloyed iron, nodular iron, compacted graphite iron, steel or non-ferrous alloys and in that heating takes place in specific zones by means of the supply of additonal flux during the solidification of the components such that they are completely compact.

10. A moulding method substantially as hereinbefore described with reference to any one of the accompanying drawings.

11. Apparatus for carrying out a moulding method according to any preceding claim.

Printed in the UK for HMSO, D8818935, 11/85, 7102.
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